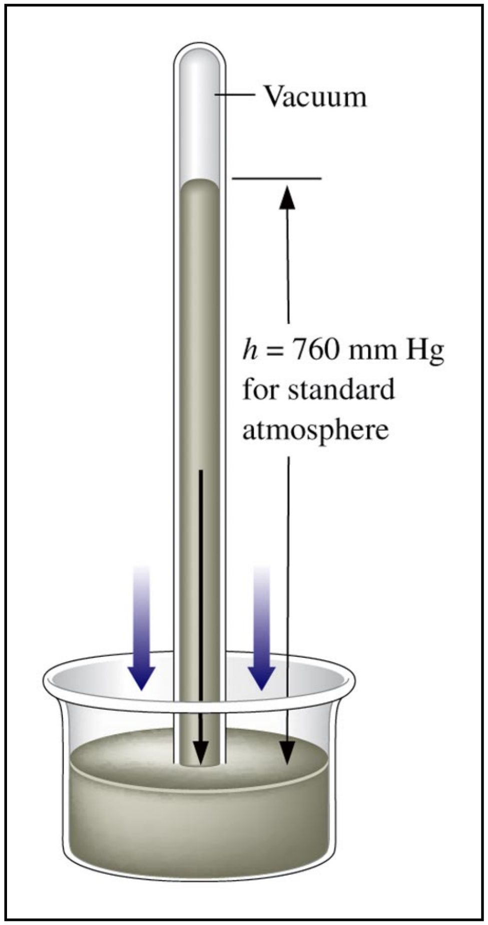
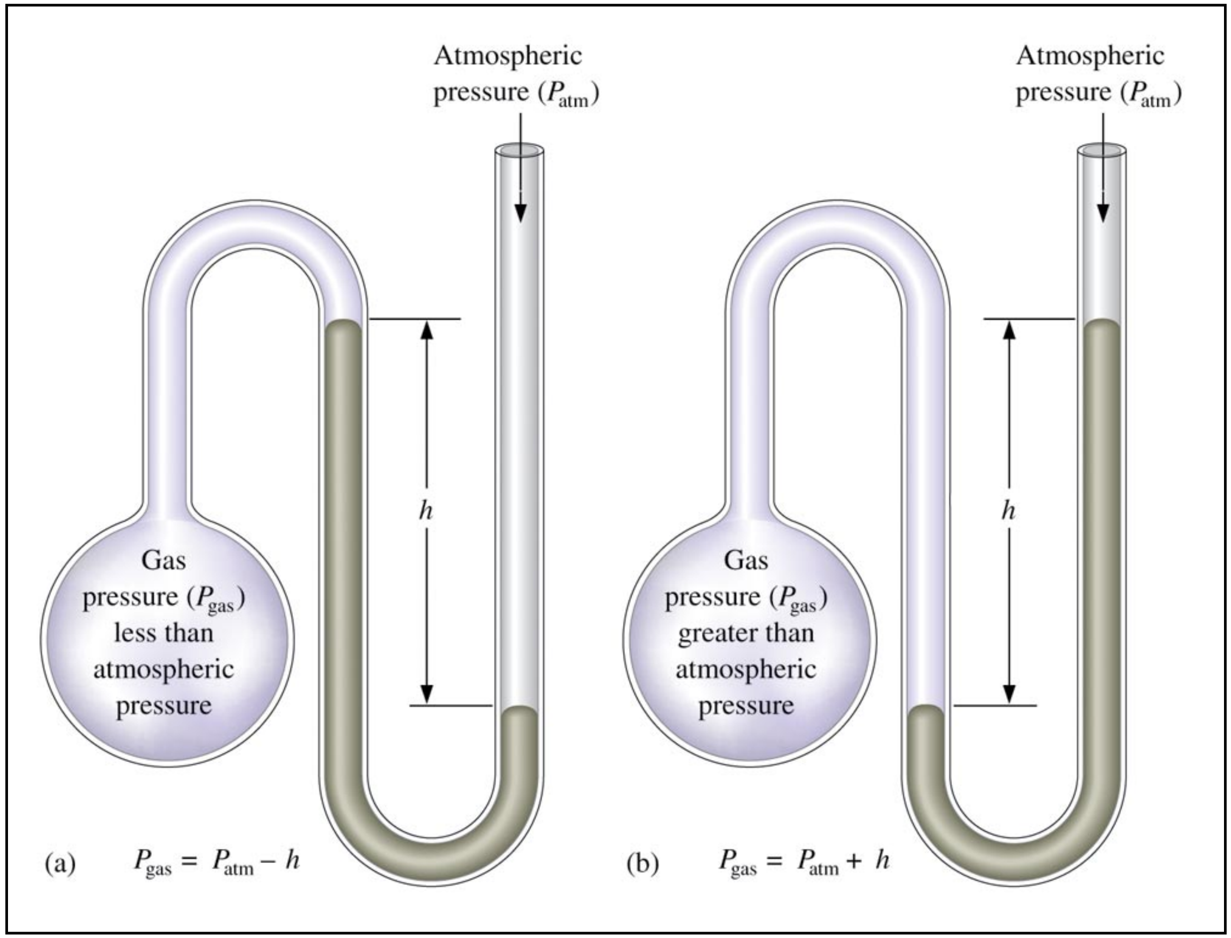


Barometer



Manometer

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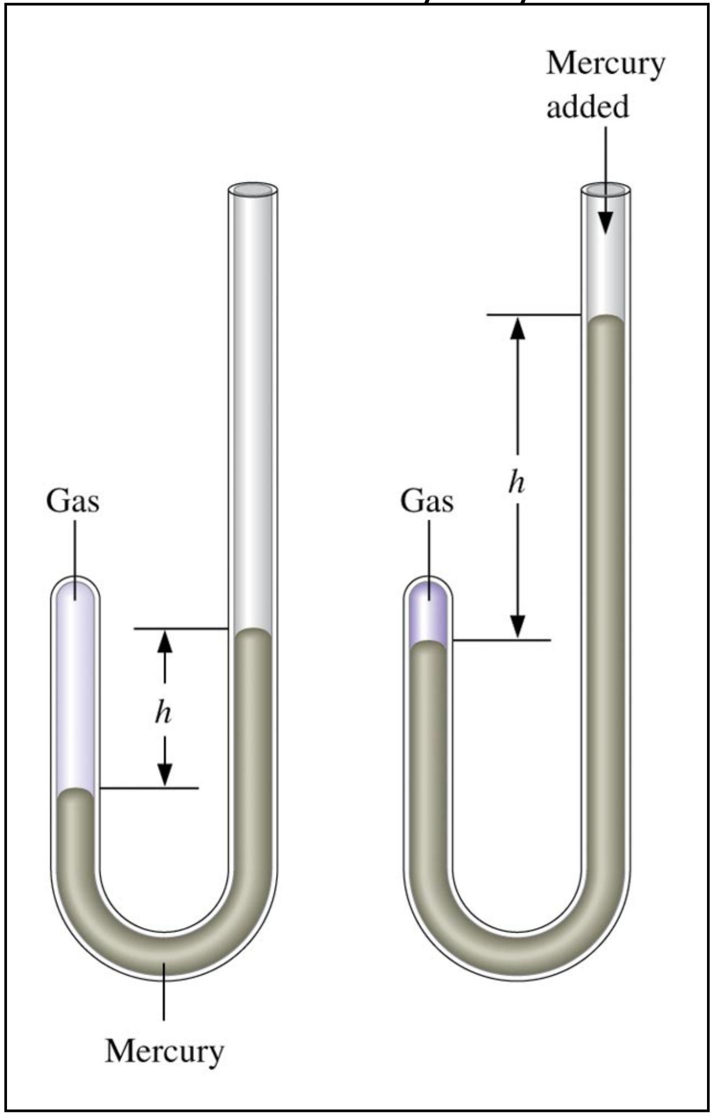
Figure 5.4 A J-Tube Similar to the One Used by Boyle



Boyle's Data Graphed

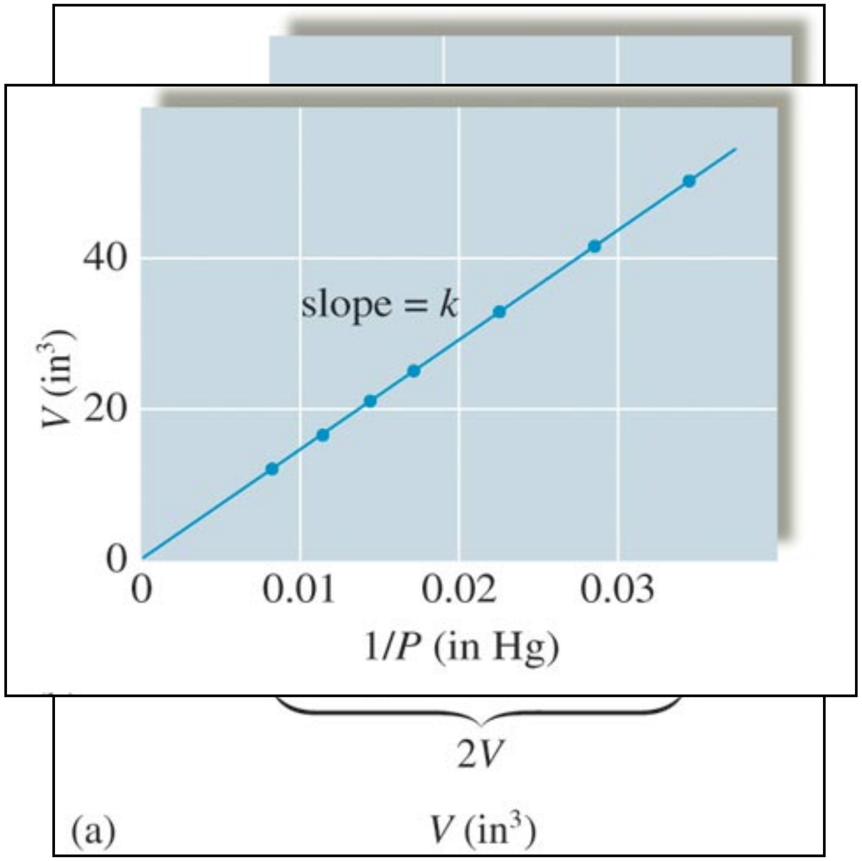


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Figure 5.6 A Plot of PV Versus P for Several Gases at Pressure Below 1 atm

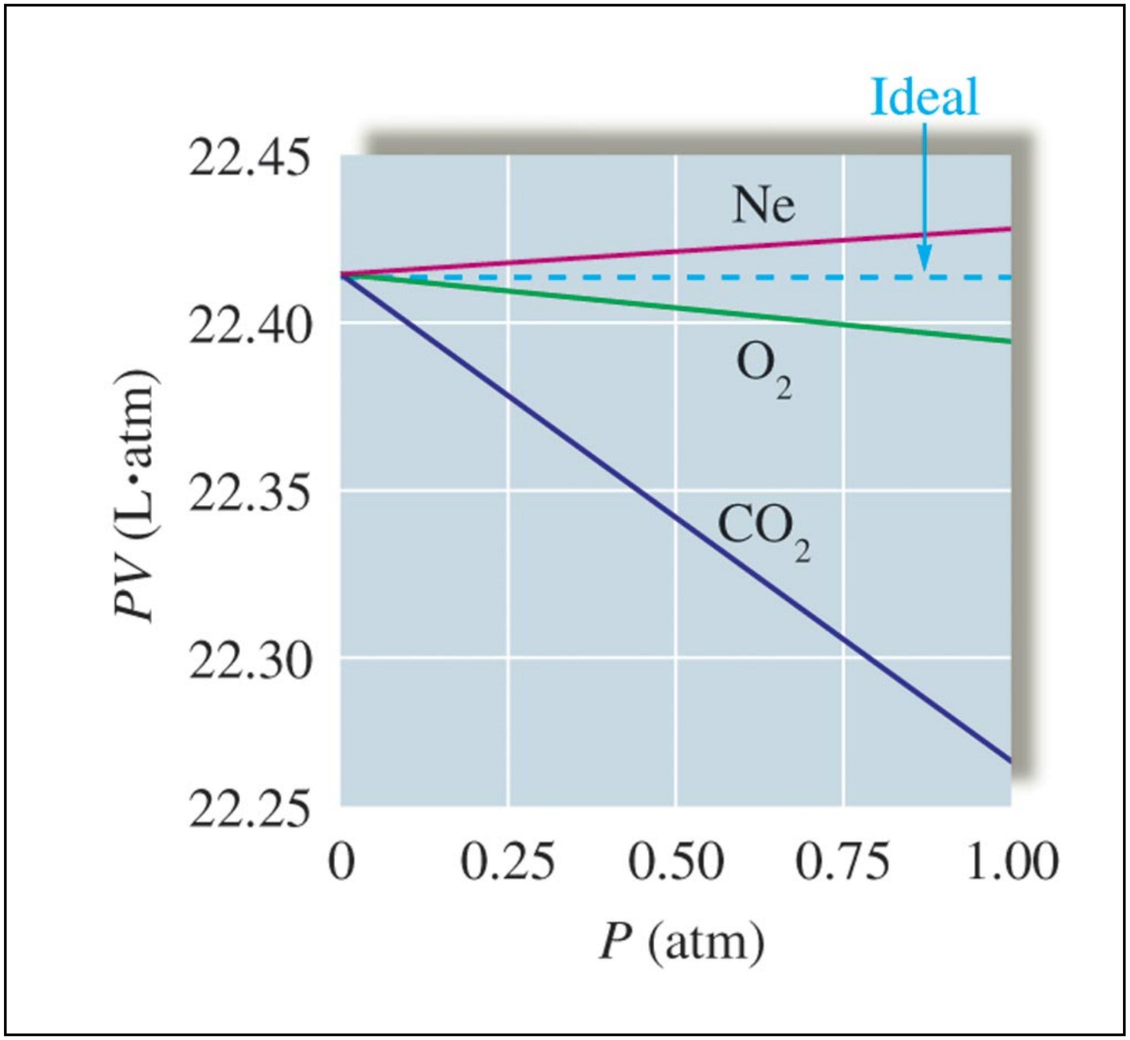

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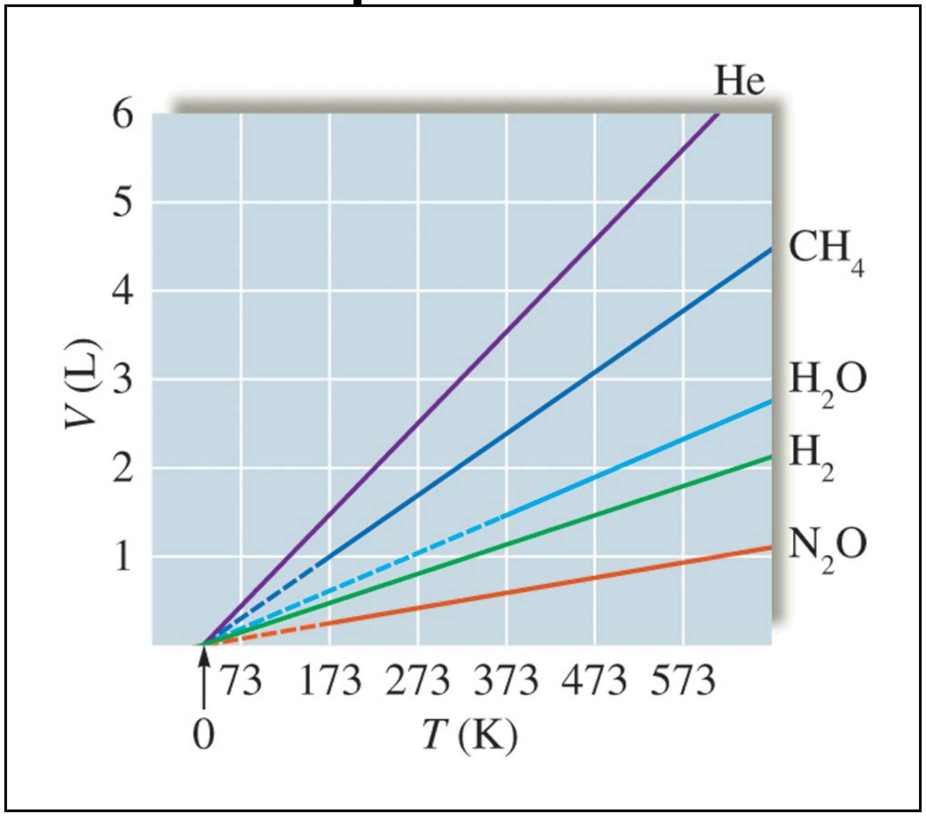
Figure 5.9 Plots of V versus T as Before, Except Here the Kelvin Scale is Used for Temperature 1



Note: Slopes are different b/c samples have different number of moles

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Figure 5.10 These Balloons Each Hold 1.0 L of Gas at 25 Celsius and 1 atm

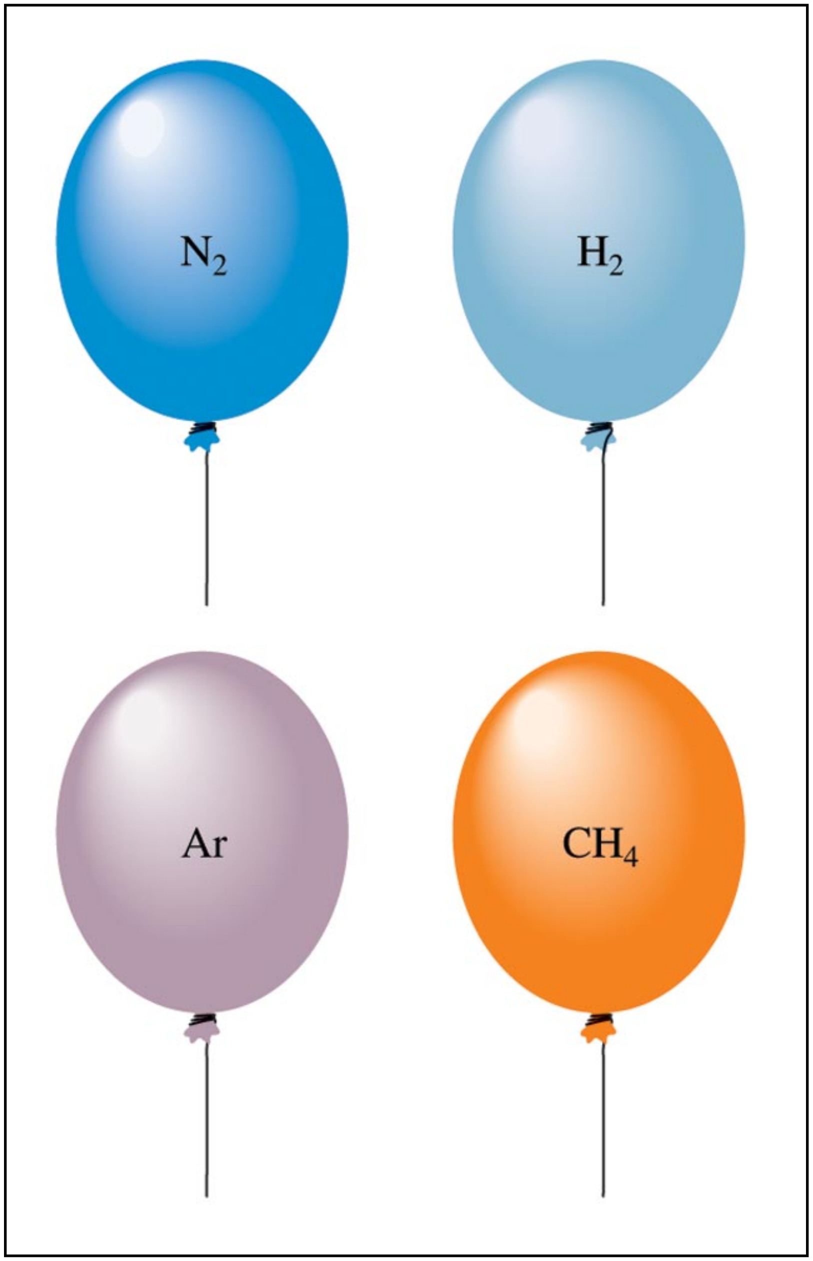

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Table 5.2 Molar Volumes for Various Gases at 0°C and 1 atm

TABLE 5.2 Molar Volumes for Various Gases at 0°C and 1 atm

Gas	Molar Volume (L)
Oxygen (O_2)	22.397
Nitrogen (N_2)	22.402
Hydrogen (H_2)	22.433
Helium (He)	22.434
Argon (Ar)	22.397
Carbon dioxide (CO_2)	22.260
Ammonia (NH_3)	22.079

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QUESTION

The primary way your body produces the CO_2 you just exhaled is from the combustion of glucose $C_6H_{12}O_6$ (molar mass = 180 g.). The balanced equation is shown here:

$$C_6H_{12}O_6\ (aq) + 6\ O_2\ (g) \rightarrow 6\ CO_2\ (g) + 6\ H_2O\ (l)$$

If you oxidized 5.42 grams of $C_6H_{12}O_6$ at STP conditions, how many liters of O_2 did you use?

Answer = 4.05L

What if this experiment was performed at 25.0^{o}C and 890 torr?

Answer = 3.77L

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Figure 5.12 The Partial Pressure of each Gas in a Mixture of Gases in a Container Depends on the Number of Moles of that Gas

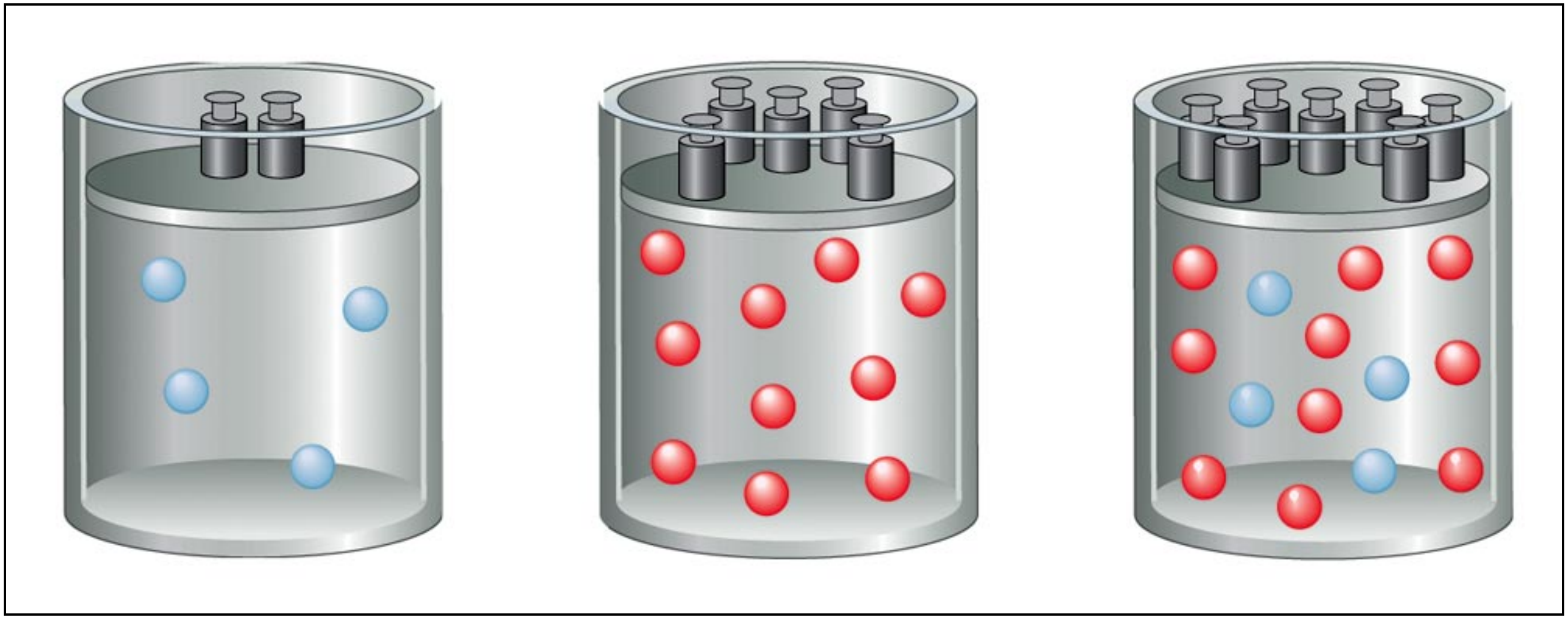

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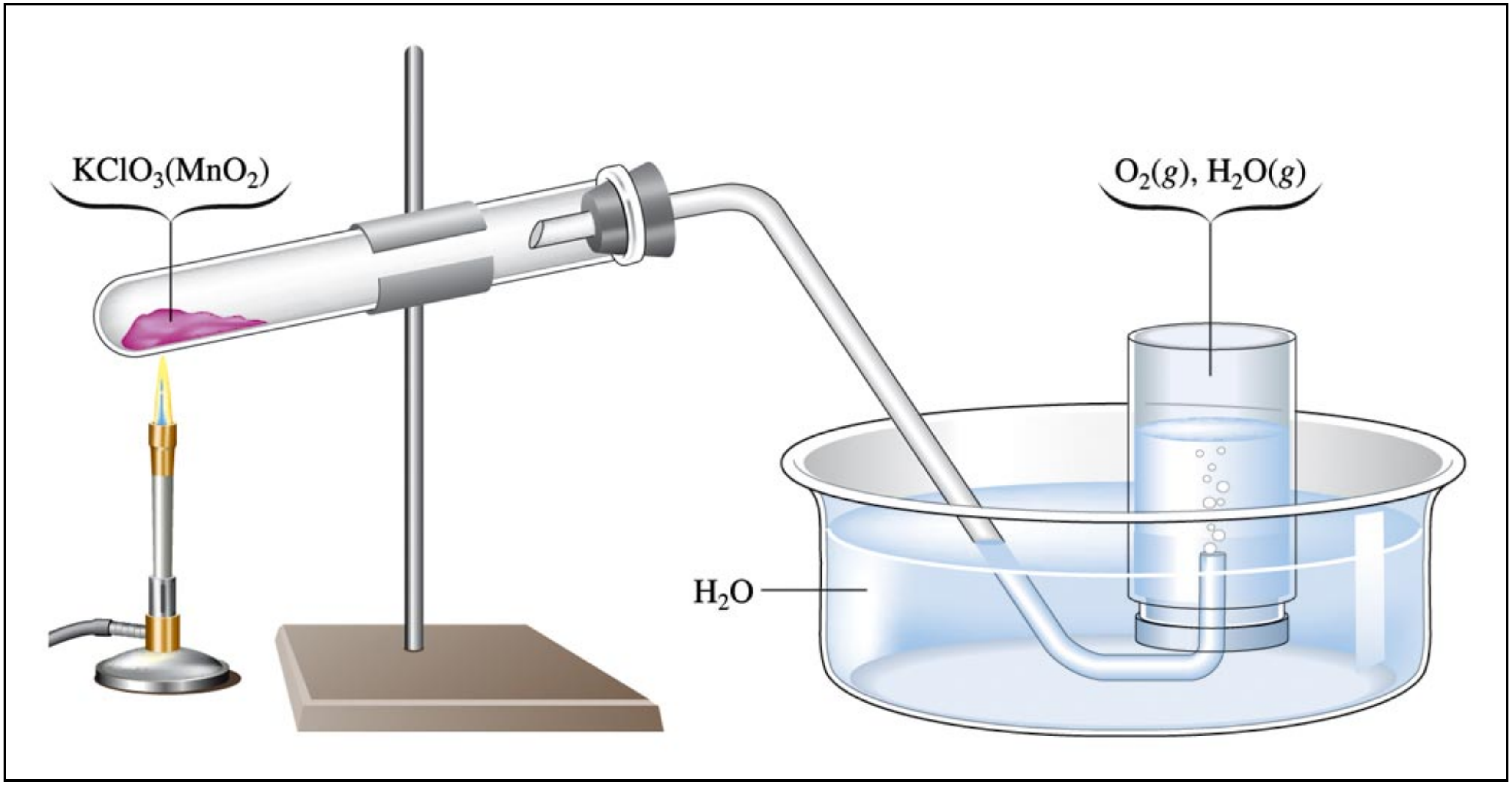
Figure 5.13 The Production of Oxygen by Thermal Decomposition of KClO3



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QUESTION

Freon-12 had been widely used as a refrigerant in air conditioning systems. However, it has been shown to be related to destroying Earth's important ozone layer. What would you calculate as the molar mass of freon-12 if you had collected 9.27 grams, **by water displacement**, in a 2.00 liter volume at 30.0°C and 764 mmHg. Water's vapor pressure at this temperature is approximately 31.8 Torr.

Answer = 120. g

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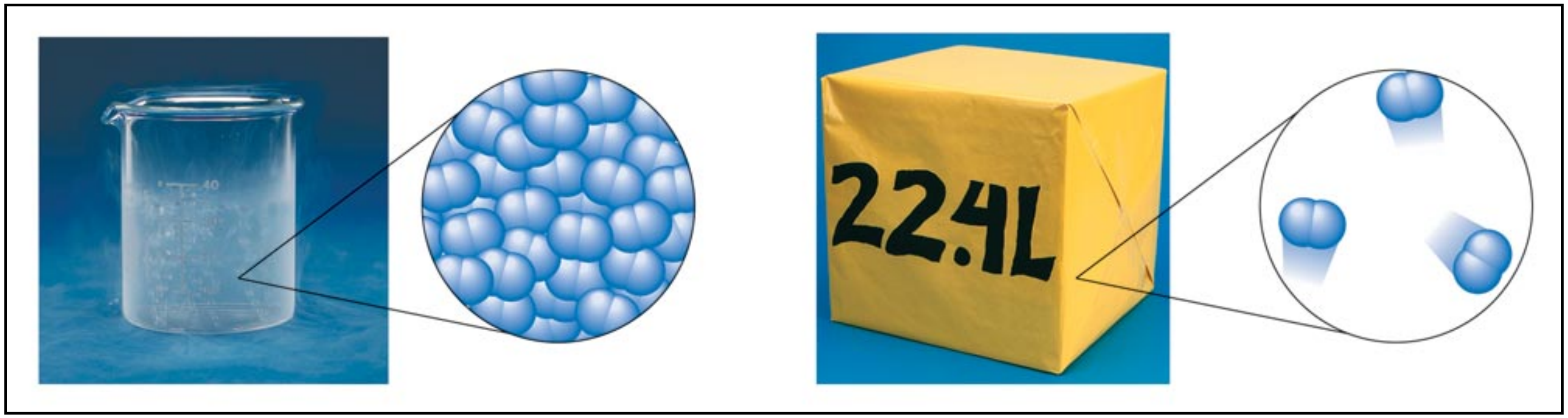
Figure 5.14 (a & b) The Ratio of the Volumes of Gaseous N_2 and Liquid N_2 is 22.4/0.035=640 and the Spacing of the Molecules is 9 Times Farther Apart in $N_2(g)$.



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Kinetic Molecular Theory (KMT)

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1. The particles in a gas are so small compared with the distance between them that **the volume of the individual particles can be assumed to be negligible (zero).** (Samples of gases have large number of particles.)

2. The particles are in constant motion. The collisions of the particles with the walls of the container are the cause of the pressure exerted by the gas.

3. The particles are assumed to exert no forces on each other.

4. The average kinetic energy of a collection of gas particles is assumed to be directly proportional to the Kelvin temperature of the gas.

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Figure 5.15 Increased Pressure due to Decreased Volume

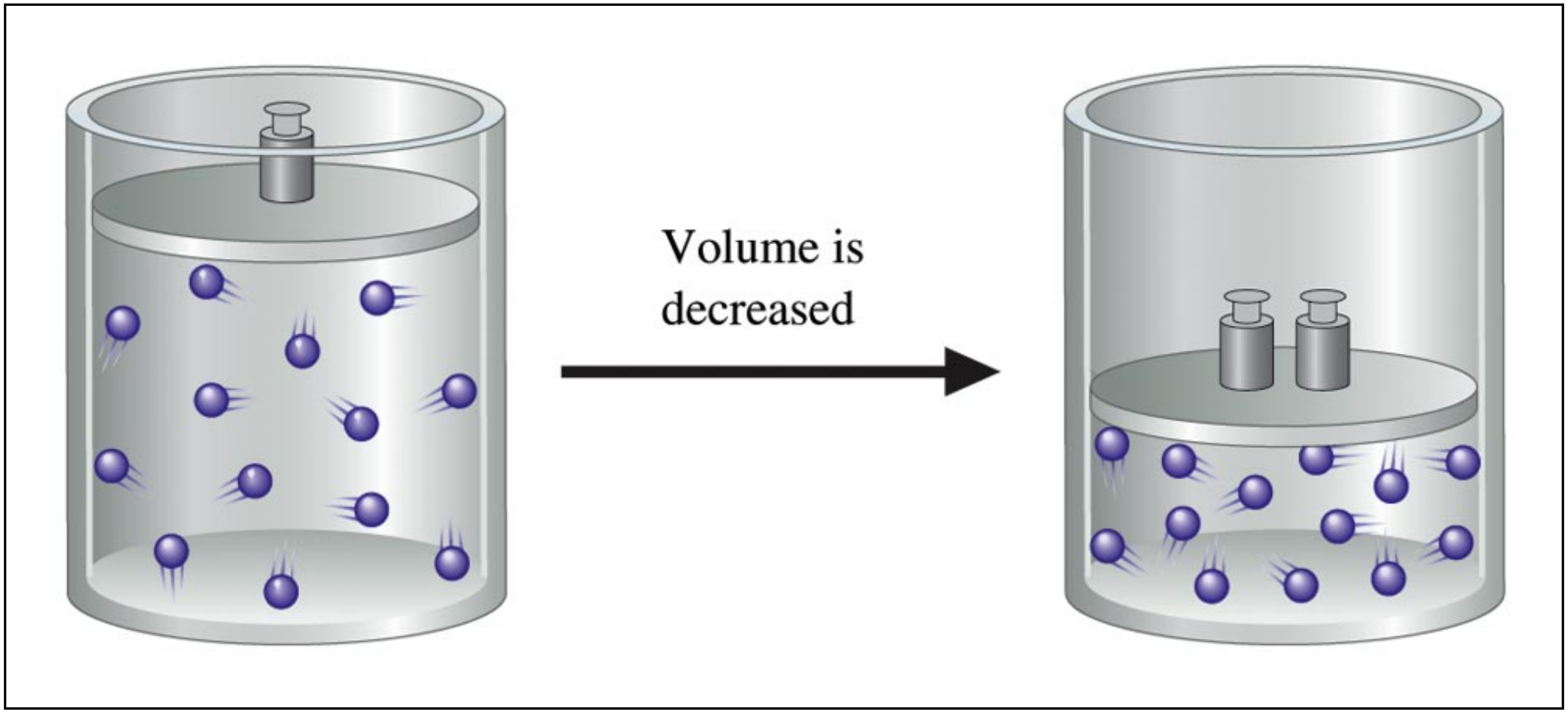

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Figure 5.16 Increased Pressure due to Increased Temperature

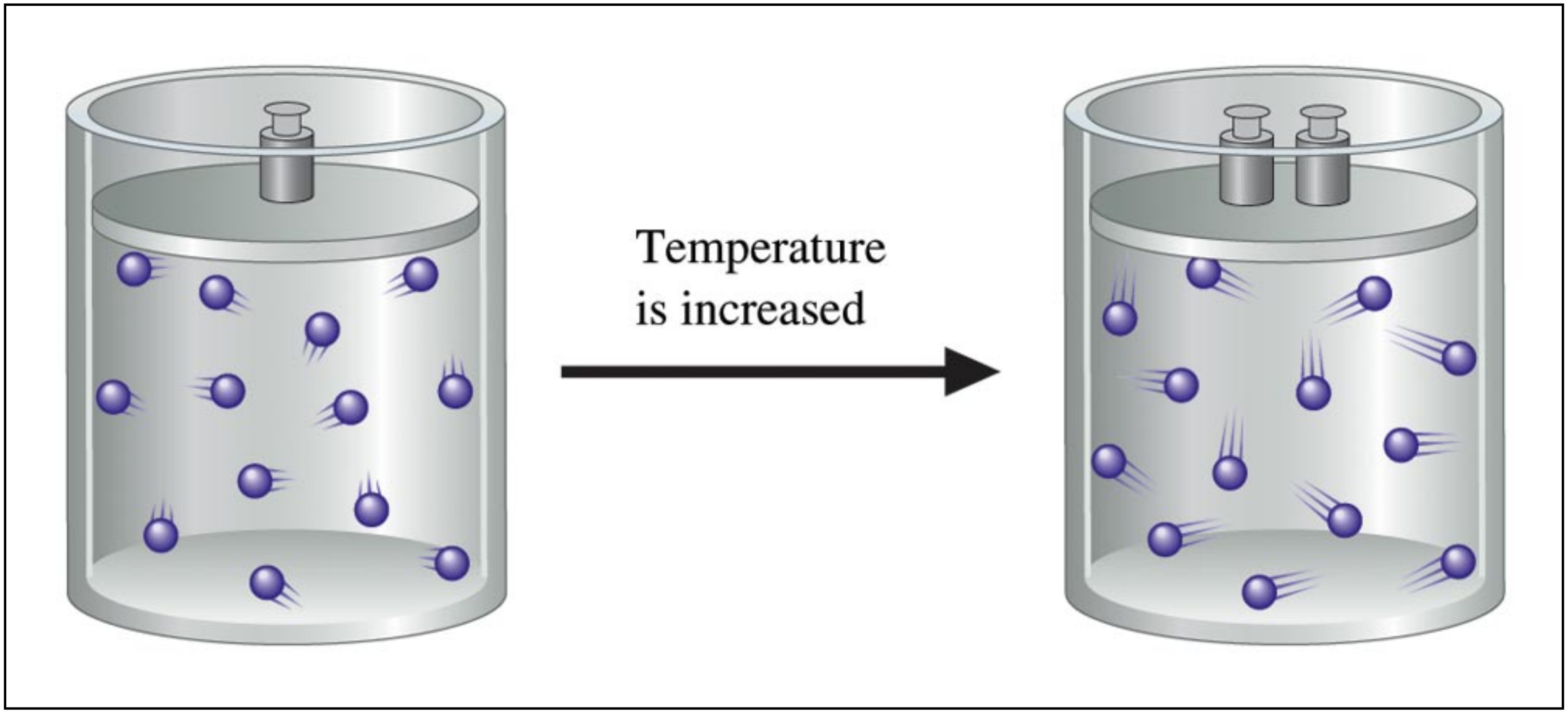

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Figure 5.17 The Effects of Increasing the Temperature of a Sample of Gas at Constant Pressure

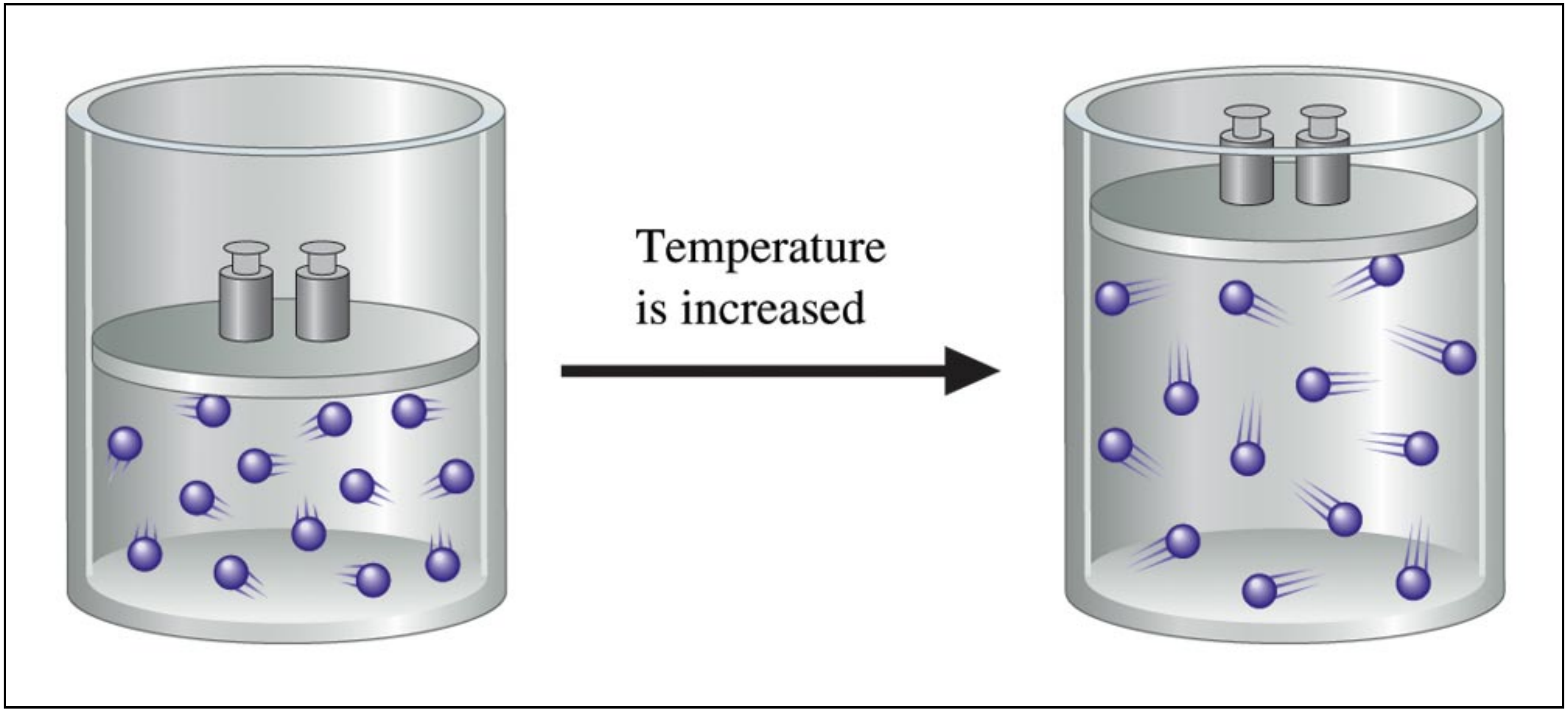

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Figure 5.18 Increased Volume due to Increased Moles of Gas at Constant Temperature and Pressure

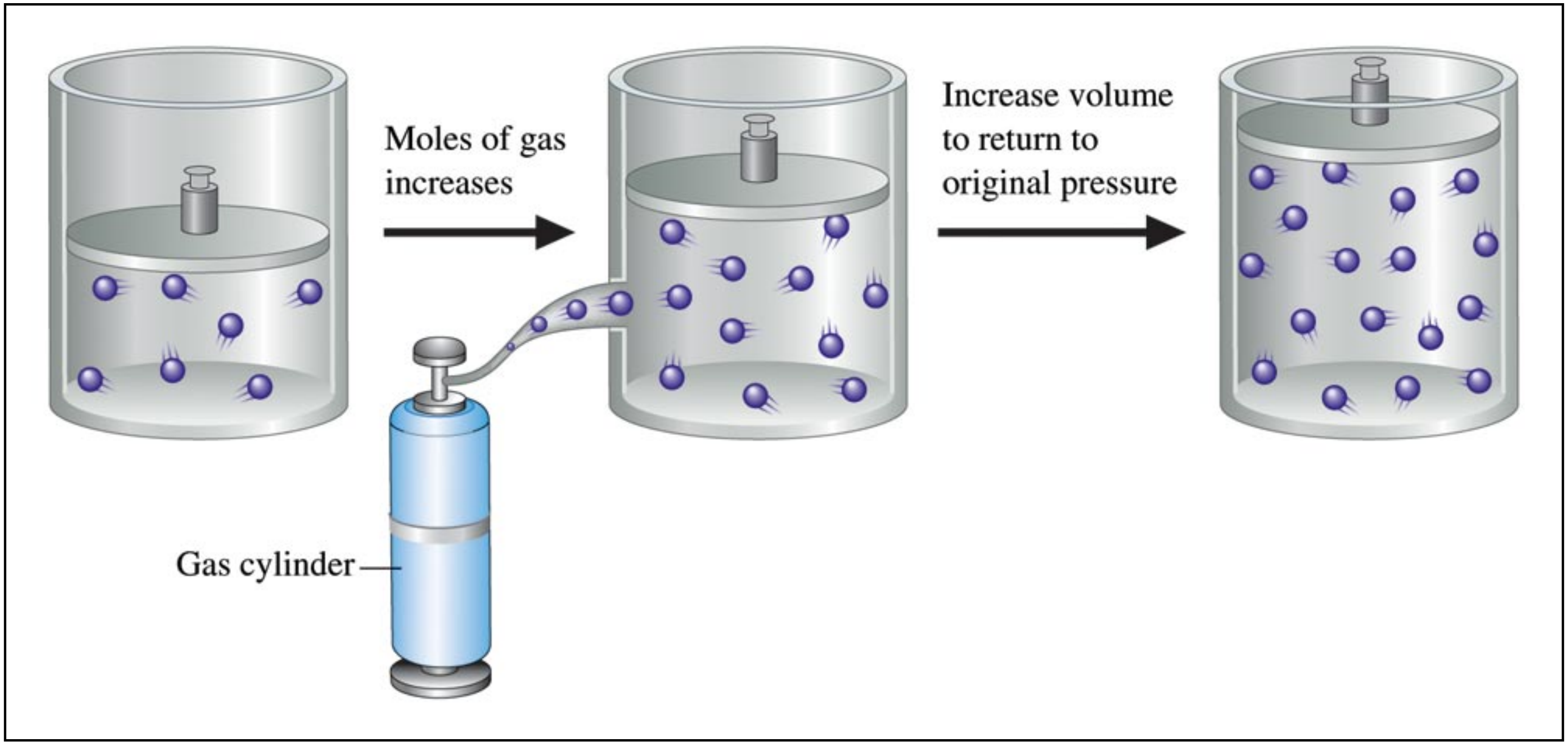

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Figure 5.19 Collisions with Walls and other Particles Cause Changes in Movement

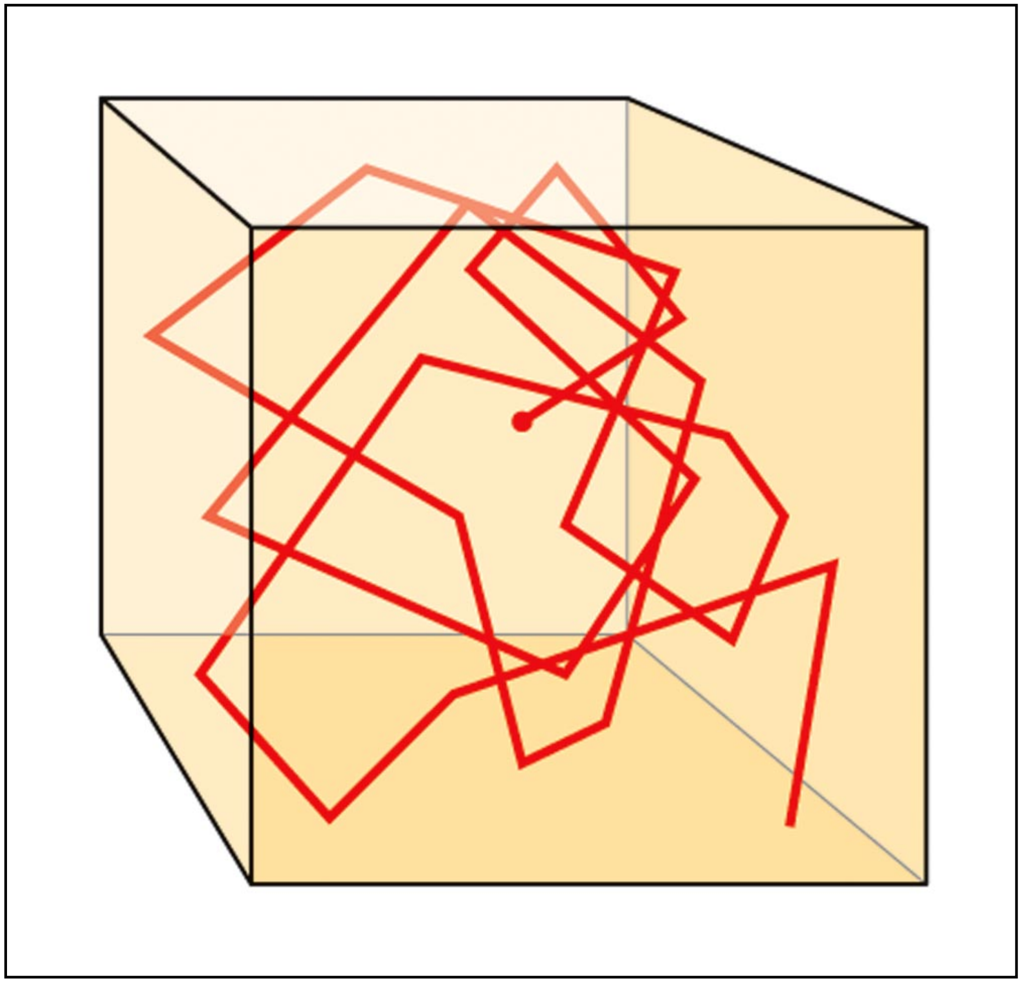

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Figure 5.20
A Plot of the Relative Number of O_2 Molecules that Have a Given Velocity at STP

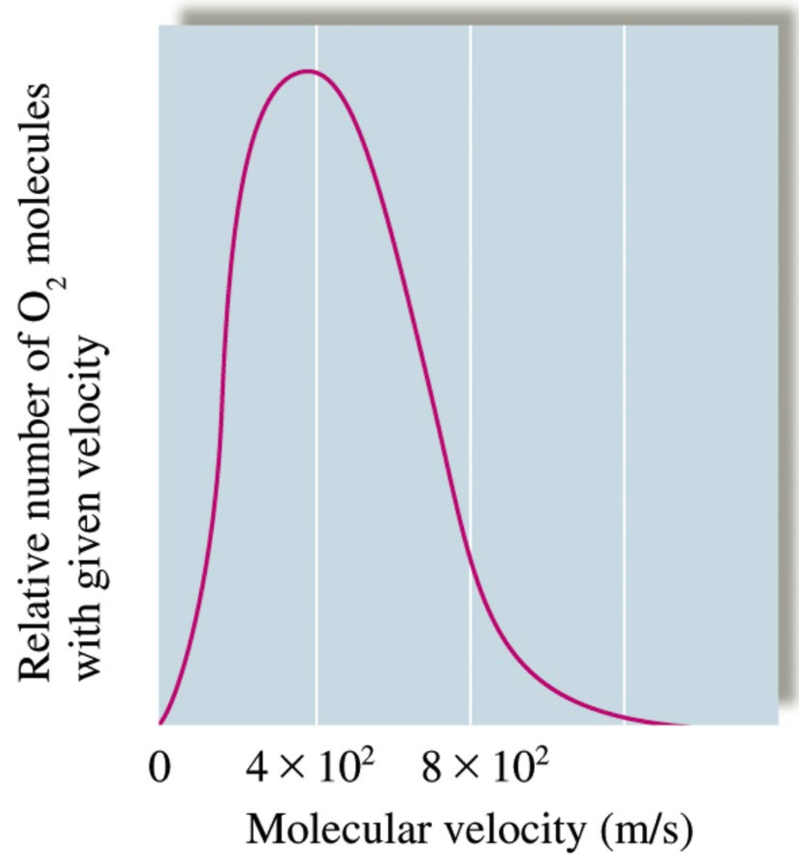

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Figure 5.21 A Plot of the Relative Number of N_2 Molecules that Have a Given Velocity at Three Temperatures

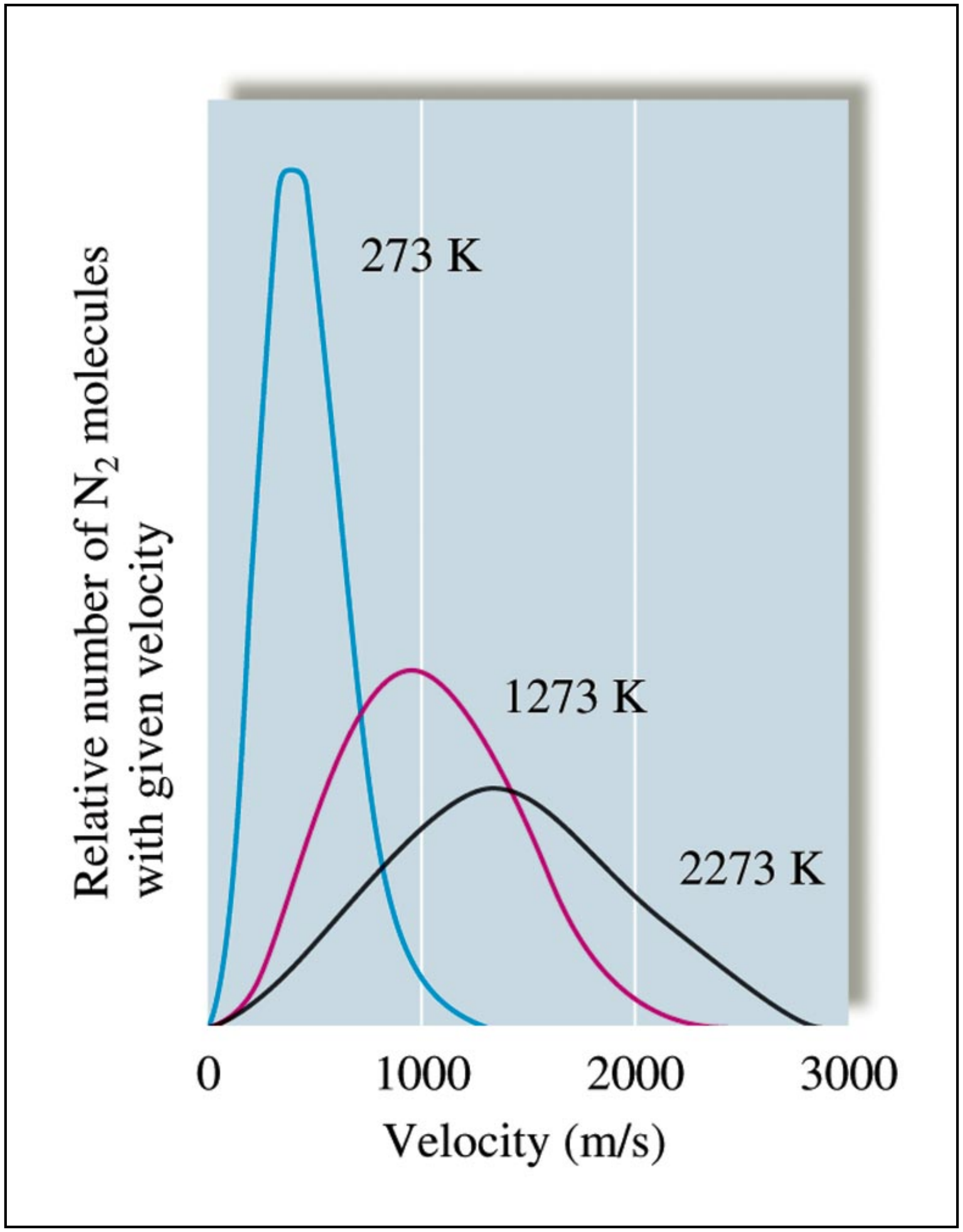

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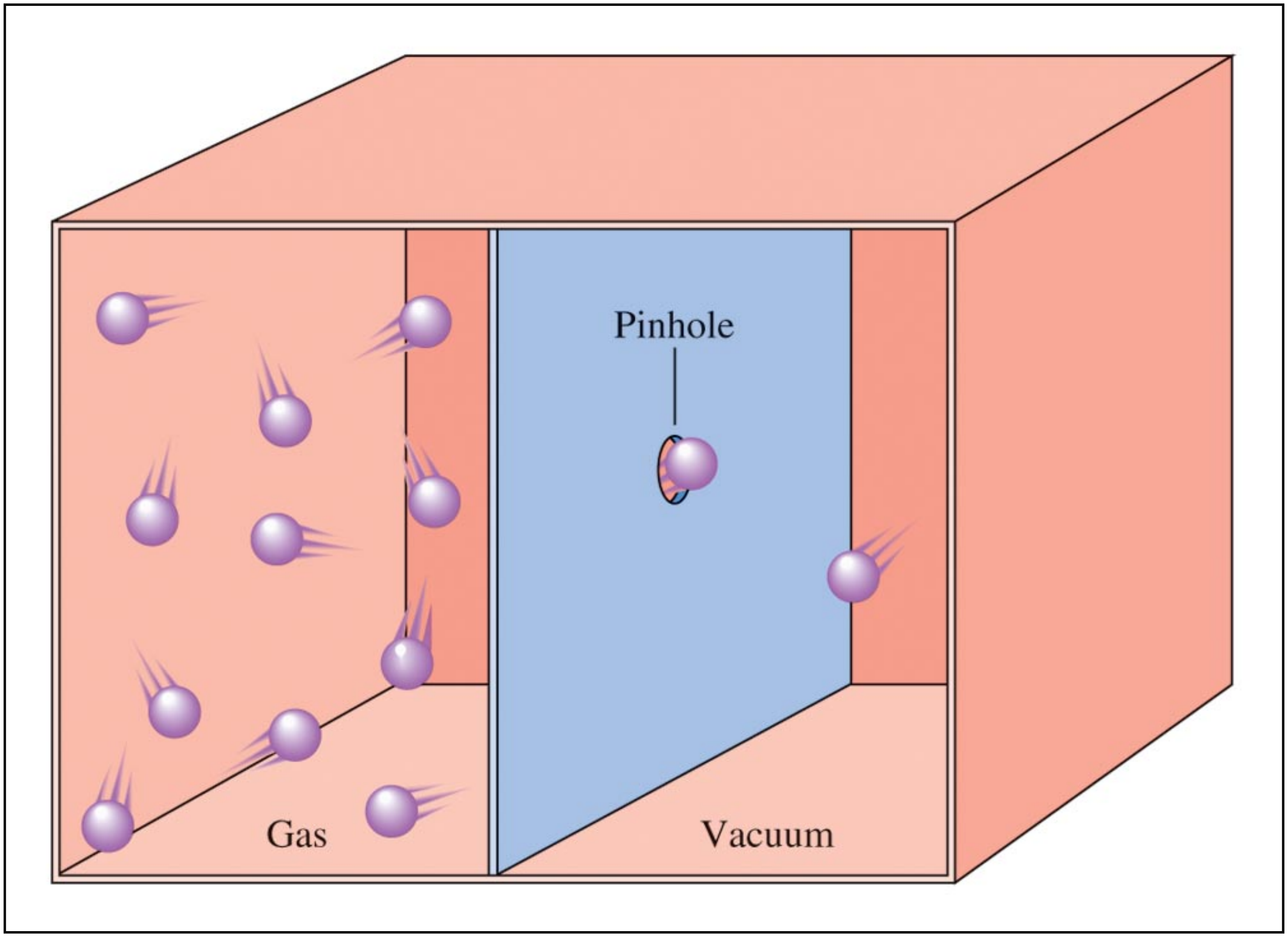
Figure 5.22 The Effusion of a Gas Into an Evacuated Chamber



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QUESTION

Calculate the effusion rates of hydrogen gas and uranium hexafluoride.

Answer = 13.2

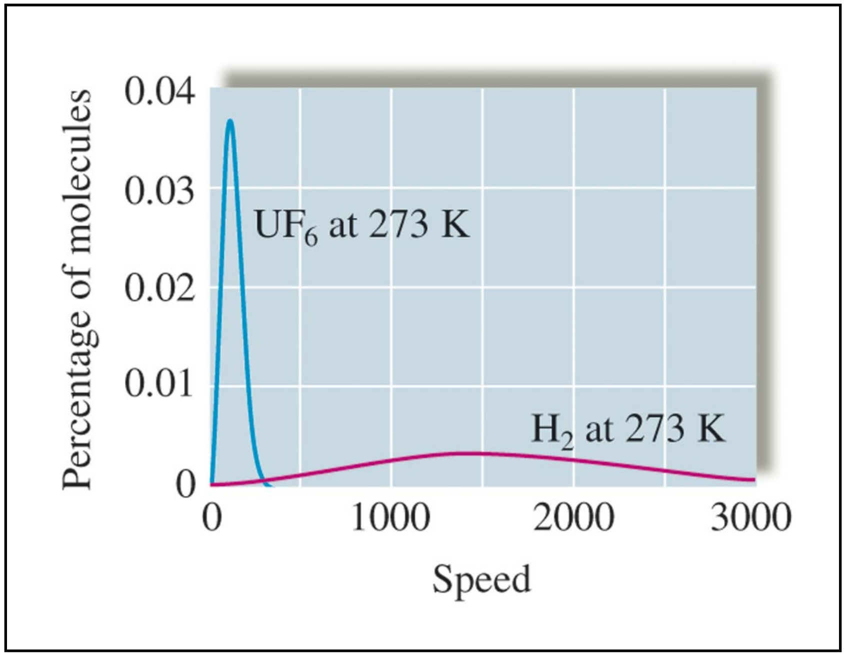

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Figure 5.25 Plots of PV/nRT versus P for Several Gases (200K)

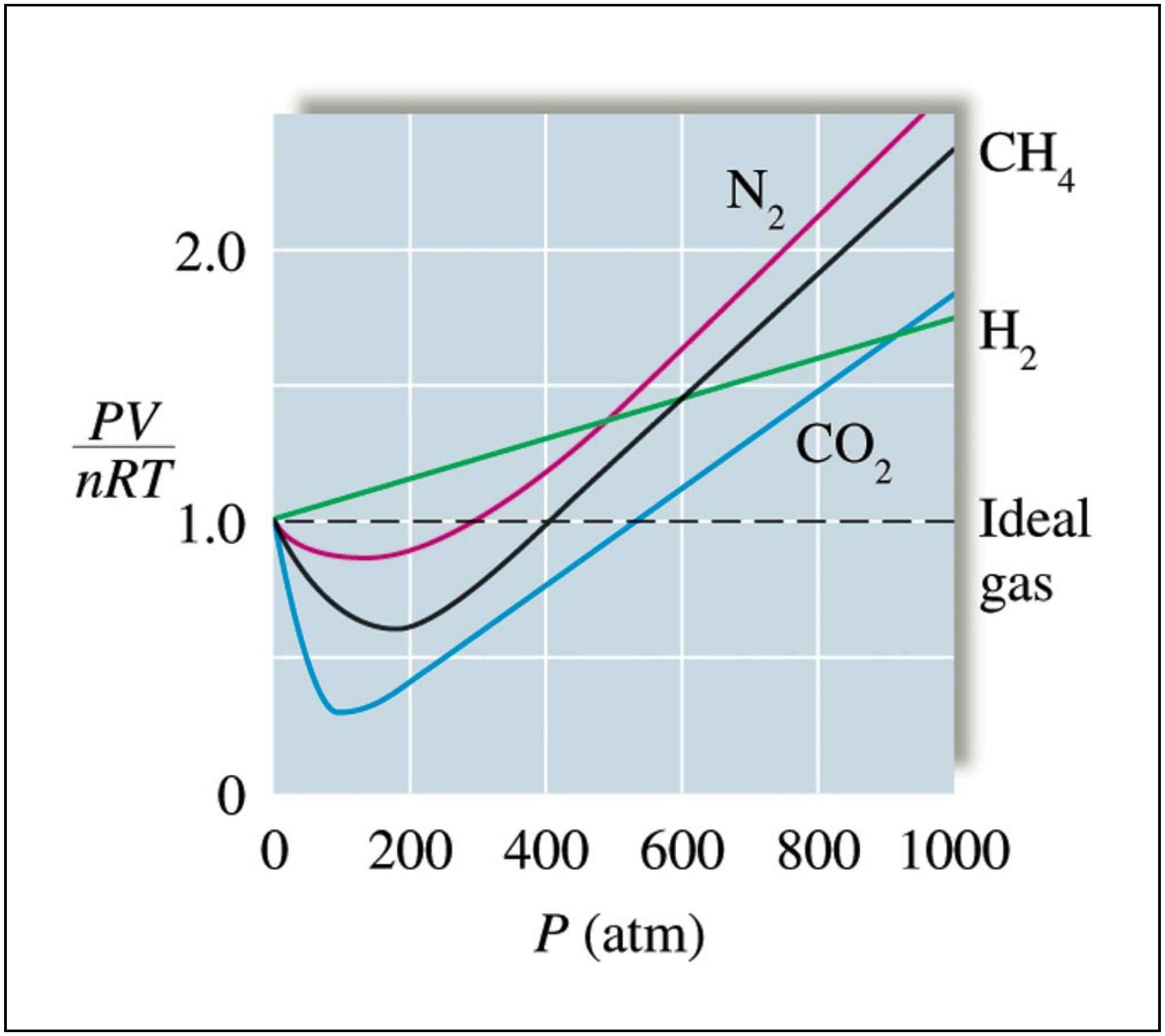

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Figure 5.26 Plots of PV/nRT versus P for Nitrogen Gas at Three Temperatures

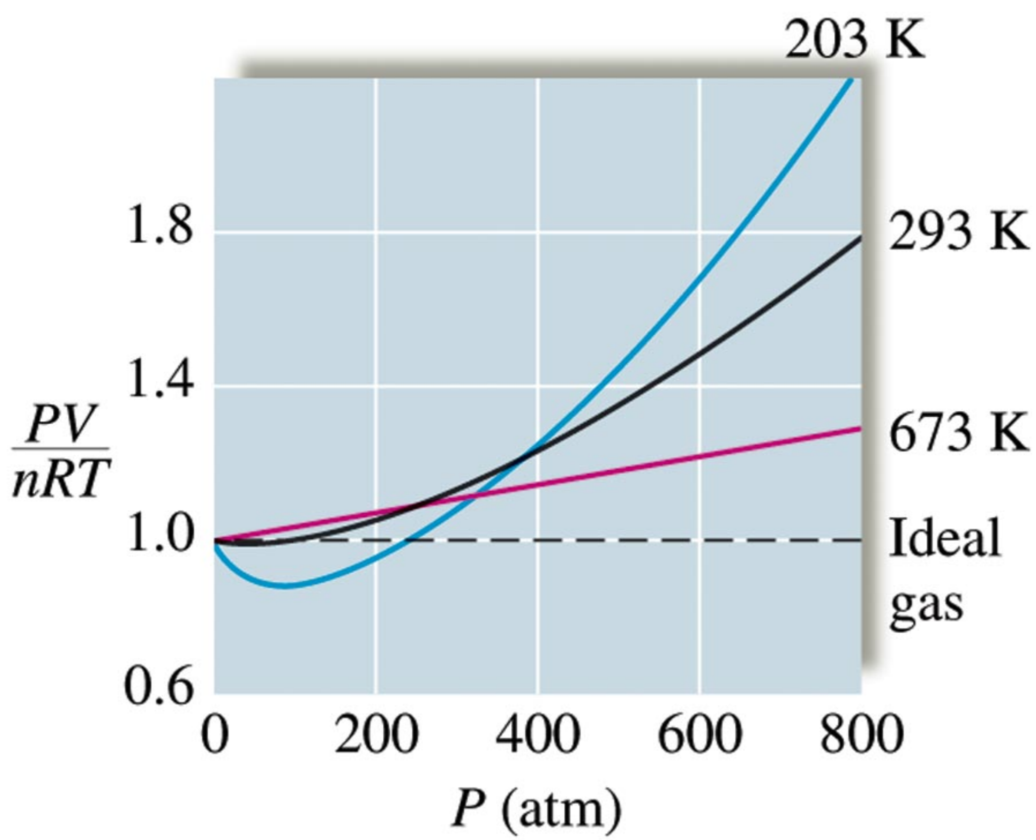

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Figure 5.27 Concentration affects the number of collisions against container walls

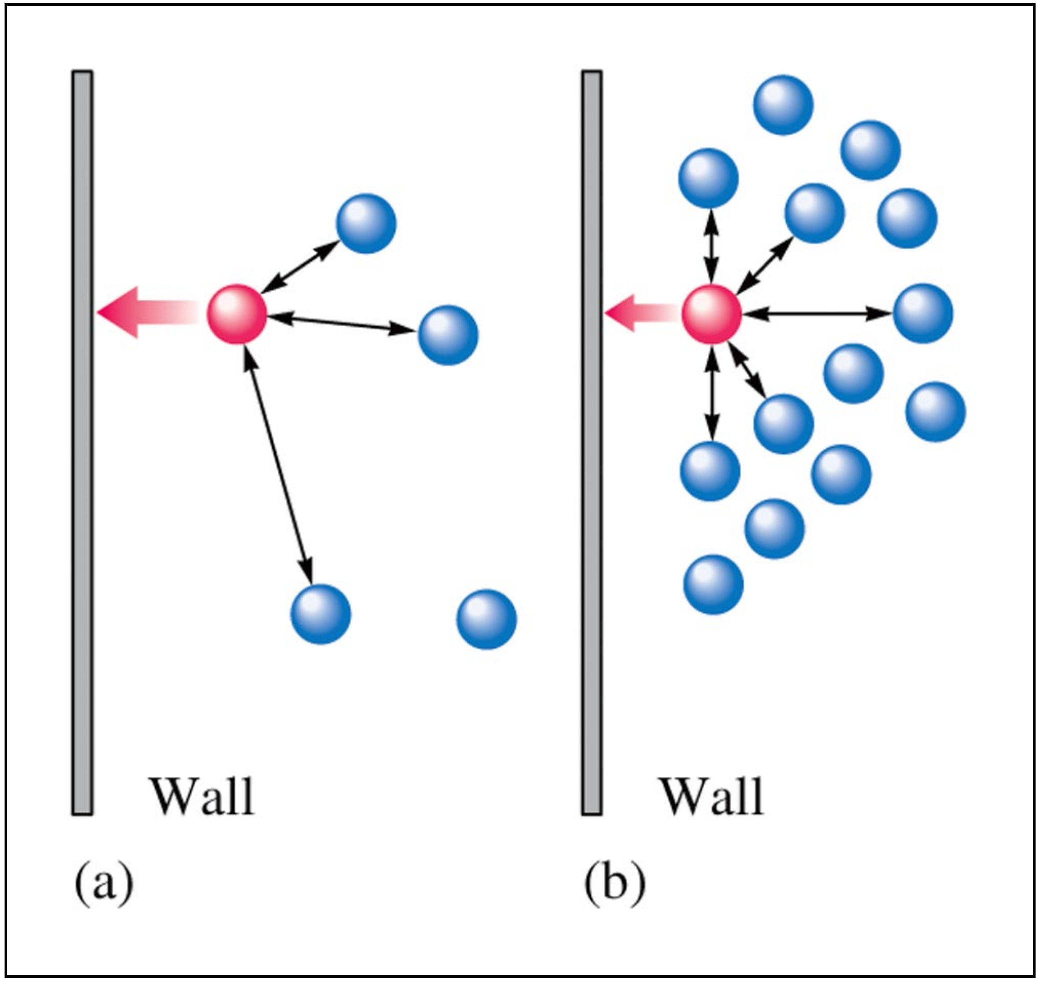

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Figure 5.28 Illustration of Pairwise Interactions Among Gas Particles

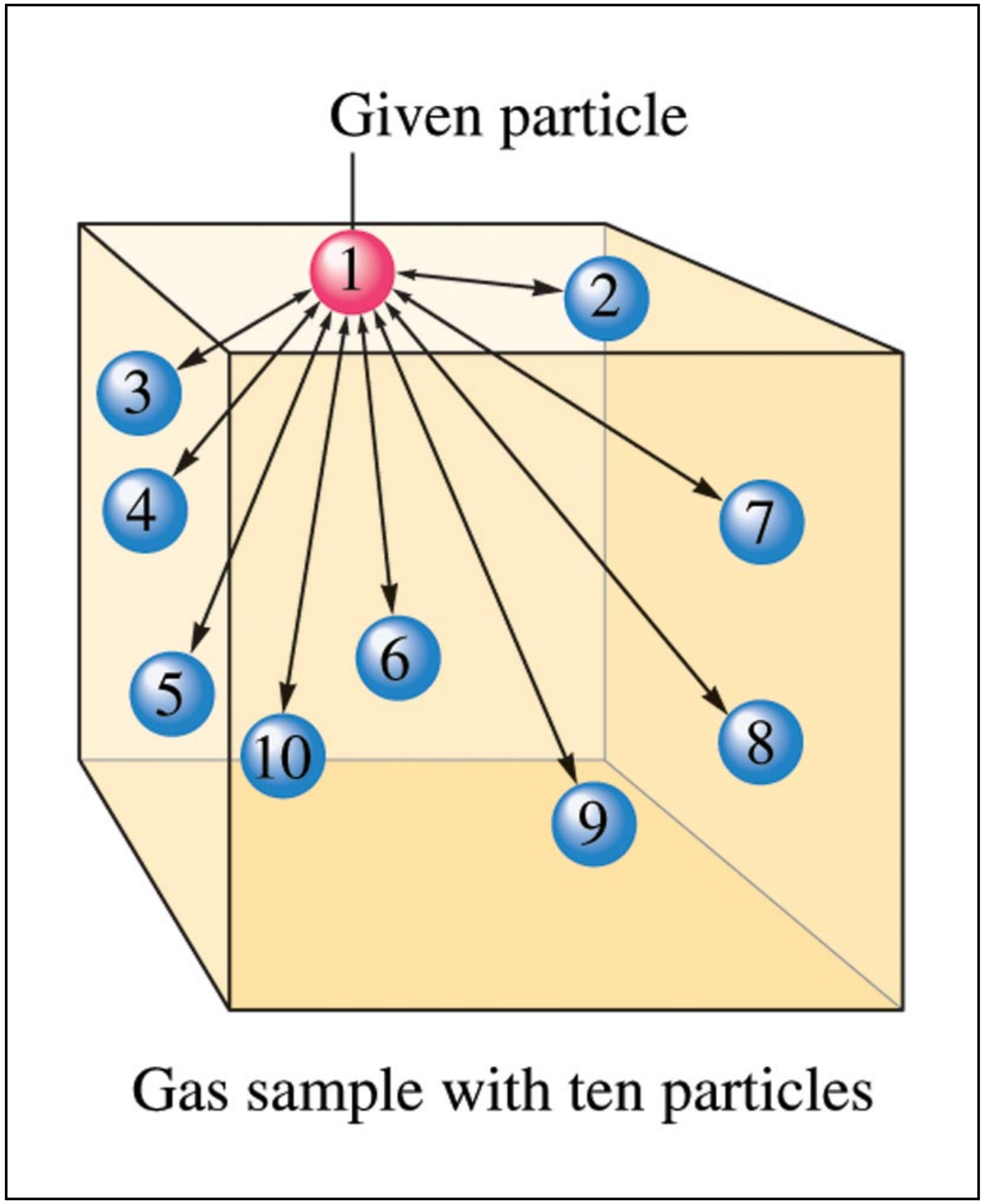

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Table 5.3 Values of the van der Waals Constants for Some Common Gases

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Gas	$a\left(\frac{atm \cdot L^2}{mol^2}\right)$	$b\left(\frac{L}{mol}\right)$
He	0.0341	0.0237
Ne	0.211	0.0171
Ar	1.35	0.0322
Kr	2.32	0.0398
Xe	4.19	0.0511
H_2	0.244	0.0266
N_2	1.39	0.0391
O_2	1.36	0.0318
Cl_2	6.49	0.0562
CO_2	3.59	0.0427
CH_4	2.25	0.0428
NH_3	4.17	0.0371
H_2O	5.46	0.0305

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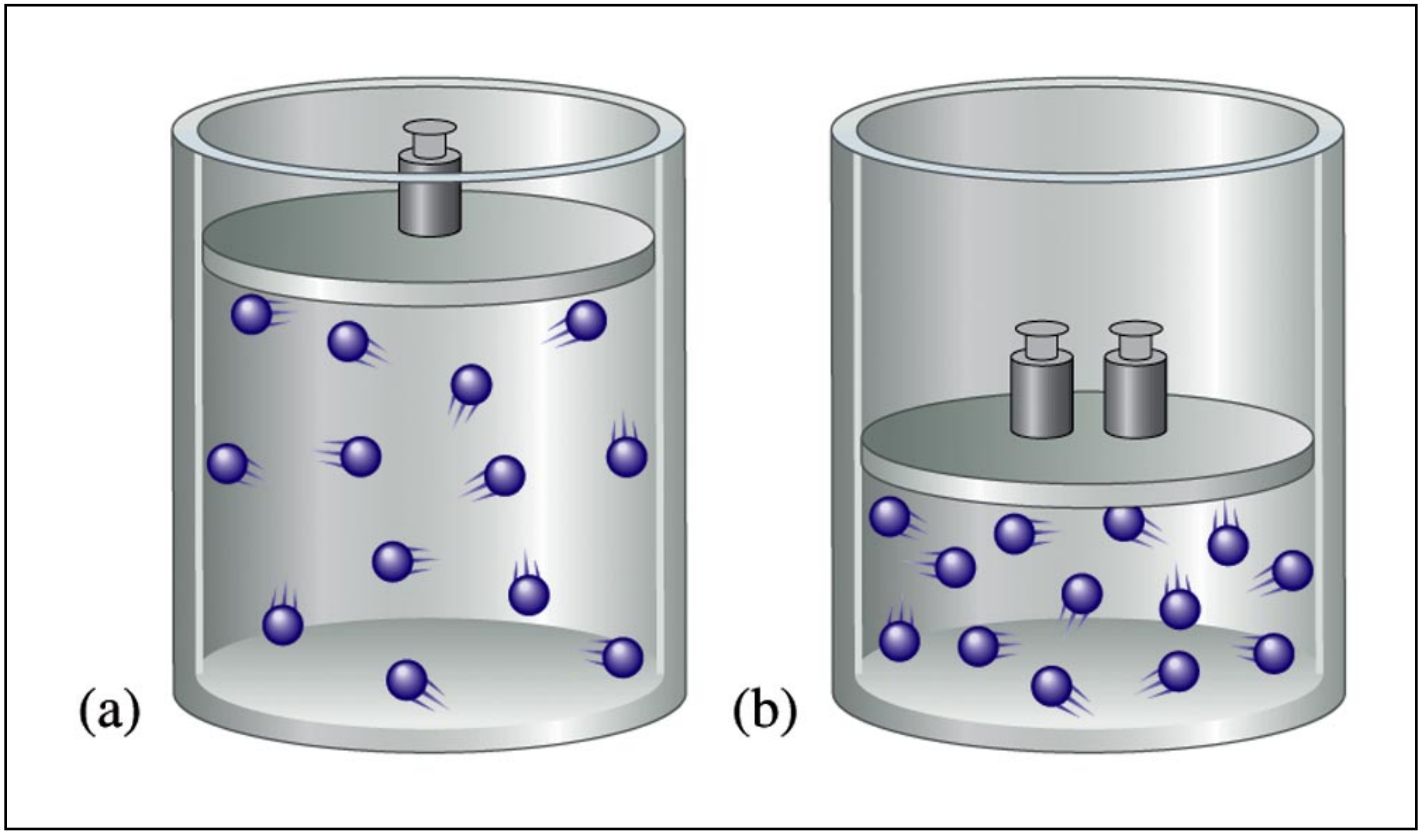
Figure 5.29a-b The Volume Taken Up by the Gas Particles Themselves is Less Important at (a) Large Container (Low Pressure) (b) Small Container (High Pressure)



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